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OPERATING INSTRUCTIONS

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1330-A

TYPE 1330-A BRIDGE OSCILLATOR

Serial # 1006
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. . . . SINCE 1915
manufacturers of
electronic apparatus
for science and industry

GENERAL RADIO COMPANY
CAMBRIDGE 39, MASSACHUSETTS, USA

747-D

OPERATING AND MAINTENANCE
INSTRUCTIONS

TYPE 1330-A
BRIDGE OSCILLATOR

Form 747-D
August, 1957

GENERAL RADIO COMPANY

275 MASSACHUSETTS AVENUE

CAMBRIDGE 39 MASSACHUSETTS

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SPECIFICATIONS

FREQUENCY RANGE:	Three fixed audio frequencies (line, 400, and 1000 cps) and a continuous range from 5 kc to 50 Mc.
FREQUENCY ACCURACY:	±5% for the 400- and 1000-cps frequencies, ±2% for carrier frequencies above 150 kc, and ±3% for carrier frequencies below 150 kc under no-load conditions. A 50-ohm resistive load may cause a frequency shift of up to +5% at some of the lower carrier frequencies. Above 150 kc, the frequency shift due to a 50-ohm load is usually less than +1%. From 5 kc to 15 Mc, the dial calibration is logarithmic.
OUTPUT VOLTAGE AND POWER:	There are two output jacks; the AUDIO output jack provides a fixed voltage output of about 12 v open-circuit, or a power output of about 3/4 watt into a matching 50-ohm load. The output at the R-F jack is controlled by the RF CONTROL, and supplies adjustable output for the 5 kc-to-50 Mc range. Over the middle of this range, open-circuit output voltage is about 10 v, and output power into a 50-ohm load (with control at maximum) is about 1 watt. Output falls off at high and low ends of the frequency spectrum.
OUTPUT IMPEDANCE:	50 ohms at AUDIO jack. 20 to 80 ohms (depending on frequency) at R-F jack with 250-ohm output control at maximum.
MODULATION:	The r-f range (15 kc to 50 Mc) can be internally amplitude-modulated at either 400 or 1000 cps at the two modulation levels of about 25% and 50%. There is no provision for external modulation. The 5-15-kc range must not be modulated.
ENVELOPE DISTORTION:	Between 1% and 6% at the 50% modulation level.
R-F DISTORTION:	The r-f distortion over most of the range is about 3%; at the lower radio frequencies it is about 6%.
LEAKAGE:	Stray fields at 1 Mc are about 50 uv per meter two feet from the oscillator. With the instrument out of its cabinet, the stray field may be increased by a factor of 10.
ACCESSORIES SUPPLIED:	Refer to paragraph 1.2.4.
POWER SUPPLY:	115 (or 230) volts at 40 to 60 cps. The power input is about 30 w.
DIMENSIONS:	Height 7-1/2 in., width 21-3/4 in., 11-1/4 in., overall.
WEIGHT:	37-1/2 lb.

U.S. Patent No. 2,548,457.

GENERAL RADIO EXPERIMENTER reference: Vol XXV No. 7, December 1950.

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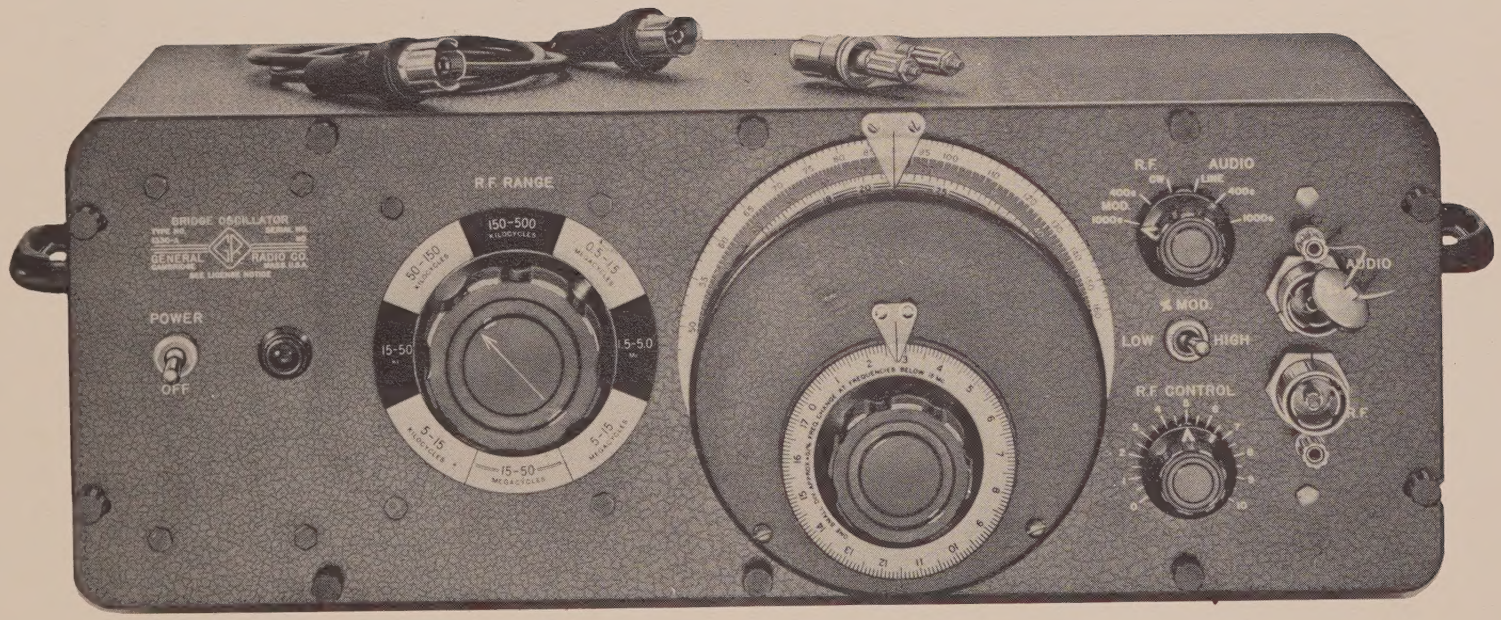


Figure 1. Type 1330-A Bridge Oscillator.

TYPE 1330-A BRIDGE OSCILLATOR

Section 1
INTRODUCTION

1.1 PURPOSE. The Type 1330-A Bridge Oscillator (Figure 1) is a stable, variable-frequency power source for bridge and other measurements at audio and radio frequencies. It supplies three fixed audio frequencies (power-line frequency, 400 and 1000 cps) and a continuous range of radio frequencies from 5 kc to 50 Mc, with a power output high enough for most laboratory measurements.

1.2 DESCRIPTION.

1.2.1 GENERAL. The Bridge Oscillator is housed in an aluminum cabinet, which can be removed for relay-rack mounting. To reduce leakage and stray fields, the radio- and audio-frequency circuits are enclosed in a completely shielded compartment within the main cabinet. The two leads for plate and heater power are carefully filtered. The shafts that extend from the compartment through the panel are shielded by the grounding of the knob inserts that enclose the shafts. The cover of the r-f compartment is of double construction with spring contacts bearing on both the inside and outside walls of the compartment.

1.2.2 CONTROLS. The following controls are on the panel of the Bridge Oscillator:

Name	Type	Function
POWER	2-pos toggle switch	Energizes instrument.
RF RANGE	8-pos selector switch	Selects any of 8 r-f ranges.
None	Continuous rotary control with slow-motion dial	Main frequency control.
RF-AUDIO	6-pos selector switch	Determines mode of operation (refer to paragraph 3.2.1).
% MOD	2-pos toggle switch	Selects either 25% (LOW) or 50% (HIGH) modulation.
RF CONTROL	Continuous rotary control	Controls r-f output power.

1.2.3 CONNECTIONS. The following connections are on the panel of the Bridge Oscillator:

Name	Type	Function
AUDIO	Type 874 Coaxial Connector and jack-top binding post (ground)	Audio output connection.
RF	Type 874 Coaxial Connector and jack-top binding post (ground)	R-f output connection.

1.2.4 ACCESSORIES. The following accessories are supplied with the Bridge Oscillator:

Item	Qty	Part No.
Adjustment wrench (mounted on oscillator cover)	1	TO-44
Power cord	1	CAP-35
Coaxial patch cord	1	874-R22
Adaptor	1	874-Q2
Cable connector	1	874-C58
Panel connector	1	874-PB58
0.50-amp Slo-Blo fuse (for 115-v)	2	FUF-1
0.25-amp Slo-Blo fuse (for 230-v)	2	FUF-1

Section 2
PRINCIPLES OF OPERATION

2.1 R-F OSCILLATOR. A Hartley-type r-f oscillator is used in the instrument. The r-f frequency range is determined by the setting of a turret which carries the eight coils and some associated components. To obtain a compact turret assembly, the coils are mounted alternately on either side of a disc that carries 48 contacts. Each of the eight ranges covers a frequency ratio of 3.33 to one (4.8 to 16 and 15 to 50).

The capacitance change of the main tuning capacitor (C1) is about 750 μμf. The plates are especially shaped to yield a logarithmic frequency calibration. The 15-50 Mc range does not use the entire capacitance span of the main tuning capacitor. The calibration for this range is not logarithmic, and the "percent frequency change" calibration on the slow-motion dial does not apply.

The voltage at the load is controlled by the RF CONTROL voltage divider. When this control is set for full output, load variations may affect the frequency. Maximum power output is obtained with a load of about 50 ohms.

With the RF-AUDIO switch at AUDIO, the r-f oscillator cathode circuit is opened, and the r-f oscillator does not function.

2.2 AUDIO OSCILLATOR AND MODULATOR. The tuned-plate-type audio oscillator uses a 6AQ5 miniature beam-power tube, with the 0.25-μf r-f oscillator plate-supply bypass capacitor serving as audio-oscillator tuning capacitor. The frequency of the audio oscillator can be either 400 or 1000 cycles. The inductor of the audio tuned circuit is tapped to change frequency, and additional capacitance (C8) is switched in for 400-cycle operation.

The heaters of the two oscillator tubes are connected in series, and the total heater-winding voltage (12.6 volts) is brought out at the AUDIO jack when the RF-AUDIO switch is in the LINE position.

The AUDIO jack is coupled directly to the audio oscillator or through a 51-ohm resistor to the heater winding. There is no provision for controlling the audio amplitude.

When the RF-AUDIO switch is in either of the MOD positions, the full swing of the audio oscillator is applied to plate-modulate and screen-modulate the r-f oscillator. The depth of modulation is about 25 percent with the % MOD switch at LOW, about 50% with the switch at HIGH, for both MOD settings of the RF-AUDIO switch.

When the RF-AUDIO switch is at one of the AUDIO positions, the plate supply is loaded by the audio oscillator tube V2 and by the resistance load R4. When the switch is at one of the R-F positions, the plate supply is loaded by the r-f oscillator and by the audio oscillator tube.

2.3 OUTPUT CHARACTERISTICS. Output characteristics of the Bridge Oscillator are as shown in Figure 2.

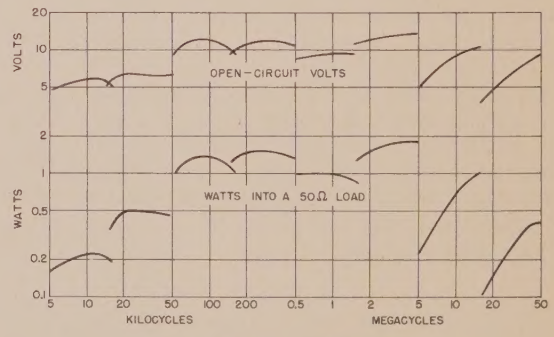


Figure 2. Typical Output Characteristics of Bridge Oscillator.

Section 3
OPERATING PROCEDURE

3.1 INSTALLATION.

3.1.1 POWER INPUT. Connect the Bridge Oscillator to a source of power as specified on the plate near the power input receptacle. Power-line frequency is 40 to 60 cycles, and voltage is either 115 or 230 volts. If you desire to change from one input voltage to the other, change the power-transformer connections as shown in Figure 4, reverse the plate near the power input receptacle, and replace the fuses (at the rear of the cabinet) with those of proper rating (refer to paragraph 1.2.4). For access to power-

transformer connections, remove the instrument from the cabinet and remove the left side shield, attached by three screws.

3.1.2 OUTPUT CONNECTIONS. If shielded connections are not required (e.g. at lower frequencies), you can plug the Type 874-Q2 Adaptor into either the RF or AUDIO panel connection. Similarly, a Type 274-M Plug can be inserted into either output connector and its associated ground terminal.

At higher frequencies, a shielded output cable should be used. The Type 874-R22 50-ohm coaxial patch cord can be plugged directly into either output jack. The Type 874-Q2 Adaptor can then be plugged into the other end of the patch cord to facilitate connections, or better still, a Type 874 Coaxial Connector can be installed at the loading equipment to maintain coaxial connections throughout.

Proper cable termination is important only at frequencies above the broadcast band and only if it is desirable to avoid standing waves and hence variations in output voltage with frequency.[1] With the RF CONTROL set for full output (fully clockwise), the 50-ohm patch cord is approximately terminated at the oscillator end.

CAUTION

Do not use either MOD position if the operating frequency is to be in the 5-15-kc range. With modulation, the r-f voltage across the tuning capacitor may be high enough to arc over. This is most likely at high modulation levels and at high line voltages.

The Type 1000-P1 Termination Unit should not be used with this instrument. The relatively high power from the Bridge Oscillator would burn out the resistor of the Termination Unit.

3.2 CONTROL SETTINGS.

3.2.1 MODE SELECTION. Set the RF-AUDIO switch to the desired mode of operation. There are three r-f positions for operation from 5 kc to 50 Mc, either unmodulated (CW) or modulated (MOD). The modulating frequency can be either 400 or 1000 cycles.

There are three audio positions for operation at either the line frequency, 400 cycles, or 1000 cycles. The amplitude of the audio output voltage at the AUDIO output jack cannot be adjusted. Output impedance at the AUDIO jack is about 50 ohms.

3.2.2 PERCENT MODULATION. With the % MOD toggle switch at LOW, the degree of modulation is about 25 percent; at HIGH, about 50 percent. There are no provisions for external modulation.

3.2.3 FREQUENCY CONTROLS. The two radio-frequency controls are the RF RANGE switch and the frequency tuning dial. Set the RF RANGE switch to the desired frequency range (refer to CAUTION in paragraph 3.2.1) and set the frequency tuning dial to the desired frequency. Use that portion of the large dial corresponding in color to the RF RANGE switch position used. Note that the 15-59 Mc position of the RF RANGE switch is identified by a double line, corresponding to the inner scale on the frequency tuning dial.

The smaller frequency-tuning dial is calibrated to indicate directly small percentage increments in frequency. Each division of this dial corresponds to a 0.1-percent change in frequency except at the ends of the main frequency dial.

[1] A.P.G. Peterson, "Output Systems of Signal Generators," General Radio Experimenter, Volume XXI, Number 1, June 1946.

Section 4
SERVICE AND MAINTENANCE

4.1 GENERAL. This service information, together with the information in preceding sections, should enable the user to locate and correct difficulties resulting from normal use. Major service problems should be referred to our Service Department, which will cooperate as much as possible by furnishing replacement parts needed as well as by supplying any necessary information. When notifying our Service Department of any difficulties in the operation or service, please specify the serial and type numbers of the instrument. Also give a complete report of the trouble encountered, and of the steps taken to eliminate the trouble.

Before returning an instrument or part for repair, please write to our Service Department, requesting a Returned Material Tag, which includes shipping instructions. Use of this tag will insure proper handling and identification. A purchase order covering repair of material returned should also be included to avoid unnecessary delay.

4.2 FREQUENCY CALIBRATION.

4.2.1 GENERAL. If the r-f oscillator tube is replaced, the frequency calibration at the high end of each range may require readjustment. A trimmer capacitor for each range is provided for this purpose. To correct for aging effects on the frequency calibration of any range, the low-frequency end of the range must first be readjusted by means of the adjustable dust core, and then the high-frequency end must be readjusted by means of the trimmer capacitor.

Trimmer capacitors are screw-driver adjustments. The dust cores require hex-wrench adjustment. A hex wrench, clipped inside the r-f compartment cover, is provided for this purpose.

4.2.2 ACCESS TO ADJUSTMENTS. Four holes in the top of the r-f compartment (see Figure 3) provide access to almost all of the dust cores and trimmer capacitors. Table 1 indicates how the adjustments may be reached. Except as otherwise noted, the RF RANGE switch must be set to the appropriate frequency range for access to adjustments.

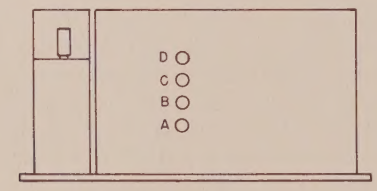


Figure 3. Locations of Dust Core and Trimmer Adjustments.

TABLE 1
LOCATION OF ADJUSTMENTS (see Figure 3)

Range	Dust Core	Trimmer
5 - 15 kc	Rear of instrument, r-f compartment cover off.	hole B
15 - 50 kc	hole A, with RF RANGE switch at 5 - 15 kc.	hole C
50 - 150 kc	hole A	hole B
150 - 500 kc	hole D	hole C
0.5 - 1.5 Mc	hole A	hole B
1.5 - 5 Mc	hole D	hole C
5 - 15 Mc	hole A	hole B
15 - 50 Mc	hole D	hole C

4.3 REMOVAL AND REPLACEMENT OF R-F SECTION.

4.3.1 REMOVAL PROCEDURE. All tubes and many components can be serviced without removal of the r-f section from its compartment. If it does become necessary to remove this section, proceed as follows, being careful not to lose the various spring washers, spacers, phenolic sleeves, etc., since they provide the means for shielding the shafts and grounding the knob inserts:

a. Remove the two black-nickeled screws that attach the cover plate of the main tuning dial to the panel. This allows removal of the cover plate, and with it the slow-motion dial assembly.

b. Remove the main tuning dial index assembly, which consists of two No. 3-48 screws, two plain washers, two lock washers, two 11/32 spacers and the plastic index.

c. Remove the RF RANGE switch knob after loosening its two setscrews. Be sure to recover the 3/8 by 3/16 by 3/32 in. rectangular phenolic "slab" that fits onto the shaft flat, the 1/4-in.-long by 3/8-in. ID metal spacer, the 1-1/16-in. OD by 3/8-in. ID metal spacer, the 1-1/16-in. OD by 3/8-in. ID by 0.01-in. phosphor bronze washer, and the 3/8-in. OD split phenolic sleeve.

d. Remove the RF - AUDIO switch knob and recover the 3/16-in.-long by 3/8-in. ID spacer and the 9/16-in. OD by 3/8-in. ID by 0.01-in. phosphor bronze washer.

e. Remove the RF CONTROL knob after loosening its setscrews, and recover the 3/16-in.-long by 1/4-in. ID spacer and the 1/2-in. OD by 1/4-in. ID by 0.008-in. phosphor bronze washer.

f. Using a long, thin-bladed screwdriver, remove the main tuning dial by loosening the two setscrews at the shaft between the dial and the panel. Recover the 7/8-in. OD by 15/32-in. ID by 0.005-in. phosphor bronze washer and the 3/8-in. ID split phenolic sleeve.

g. Using a 5/16-in. socket wrench, remove the four bright nickel hex-head screws from the panel.

h. At the rear of the instrument, remove the r-f compartment cover by prying it off. It is held quite securely in place by spring pressure.

i. Unplug the Type 874 Connectors inside the compartment.

j. Firmly grasping the rear end-plate of the main tuning capacitor, pull the entire r-f unit out of the shielded compartment.

4.3.2 OPERATION WITH R-F SECTION REMOVED FROM COMPARTMENT. To operate the instrument with the r-f unit completely removed from its compartment, remove the two No. 6-32 screws that attach the nine-jack terminal plate to the subpanel. The shaft of the main tuning capacitor goes through this plate. Note how the cable attached to the plate

is stored on the subpanel. This jack plate and its cable can be used to connect the r-f section to the corresponding plug plate, which is mounted inside the main instrument.

4.3.3 REPLACEMENT OF R-F SECTION. To reinstall the r-f section in its compartment, proceed as follows:

a. Unplug the nine-pin plug-and-jack assemblies. Carefully wind the two-foot cable about the cable supports and attach the jack plate to the subpanel by means of the two No. 6-32 screws.

b. Replace the r-f section in its shielded compartment. Fasten the unit to the panel by means of the four bright-nickel No. 10-32 screws. The subpanel spacers must bottom properly at the panel and the shafts must not bind at the panel. If there is any tendency to bind, loosen slightly and then retighten the screws (at the panel) that attach the four shaft bearing plates (behind the panel). If the plug-and-jack plates do not seem to line up properly, loosen and then retighten the two screws that attach the plug-plate.

c. Reconnect the Type 874 Connectors inside the r-f section.

d. Make sure all the panel screws are tight.

e. The RF RANGE and main tuning capacitor shafts are metal, and must not be grounded to the outside of the panel, since circulating currents would cause excessive leakage. To prevent this, the insulated shaft ends are enclosed by a grounded knob insert or disc hub.

f. To replace the main tuning dial, slip the 3/8-in. ID split phenolic sleeve onto the shaft, put on the 7/8-in. OD by 15/32-in. ID by 0.005-in. phosphor bronze washer and place the dial on the shaft. Replace the plastic index with its two 11/32-in. spacers, two plain washers, two lock washers, and two No. 3-48 screws. Orient the dial so that it indicates at the reference line with the tuning capacitor fully meshed. The accuracy of frequency calibration depends on how carefully this is done. The reference line on the main frequency dial is six degrees below the lowest calibrated frequency mark. To obtain full mesh, butt the rotor plates against a straight-edge held across the stator plates. When everything is properly lined up, press the dial firmly against the panel and tighten the two dial setscrews (between dial and panel), using a long, thin-bladed screwdriver. Make sure that the reference line is indexed for exact full-mesh. If it is not, loosen the index screws and reset the index for exact register. Then retighten the index screws.

g. Attach the dial cover plate, using the two No. 6-32 black-nickeled screws. Make sure that the slow-motion dial gear teeth properly engage the teeth of the internal gear on the main dial.

h. The RF RANGE shaft is insulated from the knob insert by a thin phenolic sleeve. A phenolic "slab" at the flat on the shaft insulates the knob's setscrew. A metal spacer and a spring washer complete the shielding and grounding.

i. Set the RF RANGE switch so that the flat of its shaft faces up (toward the 150-500 kc division). Slip the 3/8-in. OD split phenolic sleeve over the shaft, put on the 1-1/16-in. OD by 3/8-in. ID by 0.01-in. phosphor bronze washer and the 1/4-in.-long by 3/8-in. ID brass spacer. Place the 3/8 by 3/16 by 3/32-in. "slab" on the shaft flat and carefully put on the large knob, with the arrow pointing to the 150-500 kc division. Press the knob against the panel and tighten the two setscrews.

j. Replace the 1/4-in. ID washer and the 3/16-in.-long by 1/4-in. ID spacer on the shaft of the RF CONTROL, press the 1/4-in. ID small knob against the panel and tighten the two setscrews, taking care that the knob arrow points in the correct direction.

k. Replace the 9/16-in. OD by 3/8-in. ID by 0.01-in. washer and the 3/16-in.-long by 3/8-in. ID spacer on the RF-AUDIO switch shaft. Press the 3/8-in. ID small knob against the panel and tighten the two setscrews, taking care that the knob arrow points to the correct switch position.

l. Connect power and check that the instrument functions properly.

m. Replace the double-shielded cover, making sure that the 5/16-in. dust-core adjustment wrench is slipped inside the cover.

n. If the instrument is not to be relay-rack mounted, replace it in its cabinet with the 10 No. 10-32 panel screws.

4.4 TEST VOLTAGES. Table 2, Page 6, lists test voltages at tube socket pins as an aid in trouble-shooting. Voltages, d-c to ground except as otherwise noted, were measured with a 20,000-ohm-per-volt multimeter with full-scale ranges of 10, 50, 250, and 1000 volts. Variations of up to ±20% should not be considered abnormal for d-c voltages. Switch settings for the test voltages are:

RF-AUDIO at 400c MOD
frequency at 1 Mc
% MOD at LOW
RF CONTROL fully counterclockwise
input voltage: 115 volts, 60 cycles

TABLE 2
TABLE OF VOLTAGES

TUBE (TYPE)	PIN	VOLTS	TUBE (TYPE)	PIN	VOLTS	TUBE (TYPE)	PIN	VOLTS
V1 (6AQ5)	1	-21.5	V2 (6AQ5)	1	-9.3	V3 (6x4)	1	285 ac
	2	3.5		2	7.3		3	6.1ac
	3	0		3	5.9ac		4	0
	4	5.9ac		4	11.9ac		6	285 ac
	5	225		5	180		7	310
	6	157		6	180			
	7	-21.5		7	-9.3			

Section 5
PARTS LIST

	REF DES				GR NO. (NOTE A)
RESISTORS (NOTE B)	R1	47	k ±10%	1/2w	REC-20BF
	R2	15	k ±10%	1w	REC-30BF
	R3	18	k ±10%	1w	REC-30BF
	R4	6.8	k ±10%	2w	REC-41BF
	R5	18	k ±10%	2w	REC-41BF
	R6	27	k ±10%	1w	REC-30BF
	R7	470	± 5%	1/2w	REC-20BF
	R8	330	±10%	1/2w	REC-20BF
	R9	51	± 5%	2w	REC-41BF
	R10	250	±10%		POSC-12
	R12	220	± 5%	1/2w	REC-20BF
	R13	390	±10%	1/2w	REC-20BF
	R14	18	k ±10%	2w	REC-41BF
	R15	22	k ±10%	2w	REC-41BF
	R16	3.3	k ±10%	2w	REC-41BF
	R17	1	±10%	1w	REW-4C
	R19, R20, R21	580	±10%		REPO-34
	R22	15	±10%	1/2w	REW-3C
	R101	750	± 5%	1w	REC-30BF
	R102	75	k ± 5%	2w	REC-41BF
	R201	47	k ±10%	2w	REC-41BF
	R202	47	k ±10%	2w	REC-41BF
CAPACITORS (NOTE C)	C1	820 µµf			848-404-2
	C2	35 µµf	± 5%		COM-20B
	C3	0.25	± 5%		COU-29
	C4	0.5	+20%-10%		COU-17
	C5	0.002	+30%-10%		COU-28
	C6	0.02	±10%		COL-33
	C7	0.05	±10%		COL-18
	C8	0.25	± 5%		COL-64
	C9	20	450dcwv		COE-5
	C10	0.5	+20%-10%		COU-17-3
	C11	0.5	+20%-10%		COU-17-3
	C12, C13, C14, C15	20	450dcwv		COEB-25
	C16	0.01	±10%		COM-35B
	C17	0.01	±10%		COM-35B

	REF DES		GR NO. (NOTE A)
	C101	7-45µµf	COT-12
	C201	7-45µµf	COT-12
	C301	7-45µµf	COT-12
	C401	7-45µµf	COT-12
	C501	7-45µµf	COT-12
	C601	7-45µµf	COT-12
	C701	7-45µµf	COT-12
	C801	7-45µµf	COT-12
MISCELLANEOUS	F1	FUSE, 0.5 amp Slo-Blo Type 3AG (for 115v)	FUF-1
	F1	FUSE, 0.25 amp Slo-Blo Type 3AG (for 230v)	FUF-1
	F2	FUSE, 0.5 amp Slo-Blo Type 3AG (for 115v)	FUF-1
	F2	FUSE, 0.25 amp Slo-Blo Type 3AG (for 230v)	FUF-1
	L101, L102	INDUCTOR	1330-28
	L201, L202	INDUCTOR	1330-29
	L301, L302	INDUCTOR	1330-201
	L401, L402	INDUCTOR	1330-202
	L501, L502	INDUCTOR	1330-203
	L601	INDUCTOR	1330-204
	L602	INDUCTOR	1330-205
	L701	INDUCTOR	1330-206
	L702	INDUCTOR	1330-207
	L801	INDUCTOR	1330-27
	L802	INDUCTOR	1330-208
	L803	INDUCTOR	CHA-49
	P1	LAMP. 6.3v Mazda 44	2CAP-939
	S1	SWITCH, 8 pos	1330-37
	S2	SWITCH	SWRW-55
	S3	SWITCH, dpst	SWT-333
	S4	SWITCH, dpdt	SWT-335
	T1	TRANSFORMER	345-454
	T2	TRANSFORMER	485-465

NOTES: (A) Part No. designations for resistors and capacitors are as follows:
COE - Capacitor, electrolytic
COEB - Capacitor, electrolytic block
COL - Capacitor, oil
COM - Capacitor, mica
COU - Capacitor, unclassified
POSC - Resistor, variable, composition
REC - Resistor, composition
REPO - Resistor, power
REW - Resistor, wire-wound

(B) All resistances are in ohms except as otherwise indicated by k (kilohms).
(C) All capacitances are in microfarads, except as otherwise indicated by µµf (micromicrofarads).

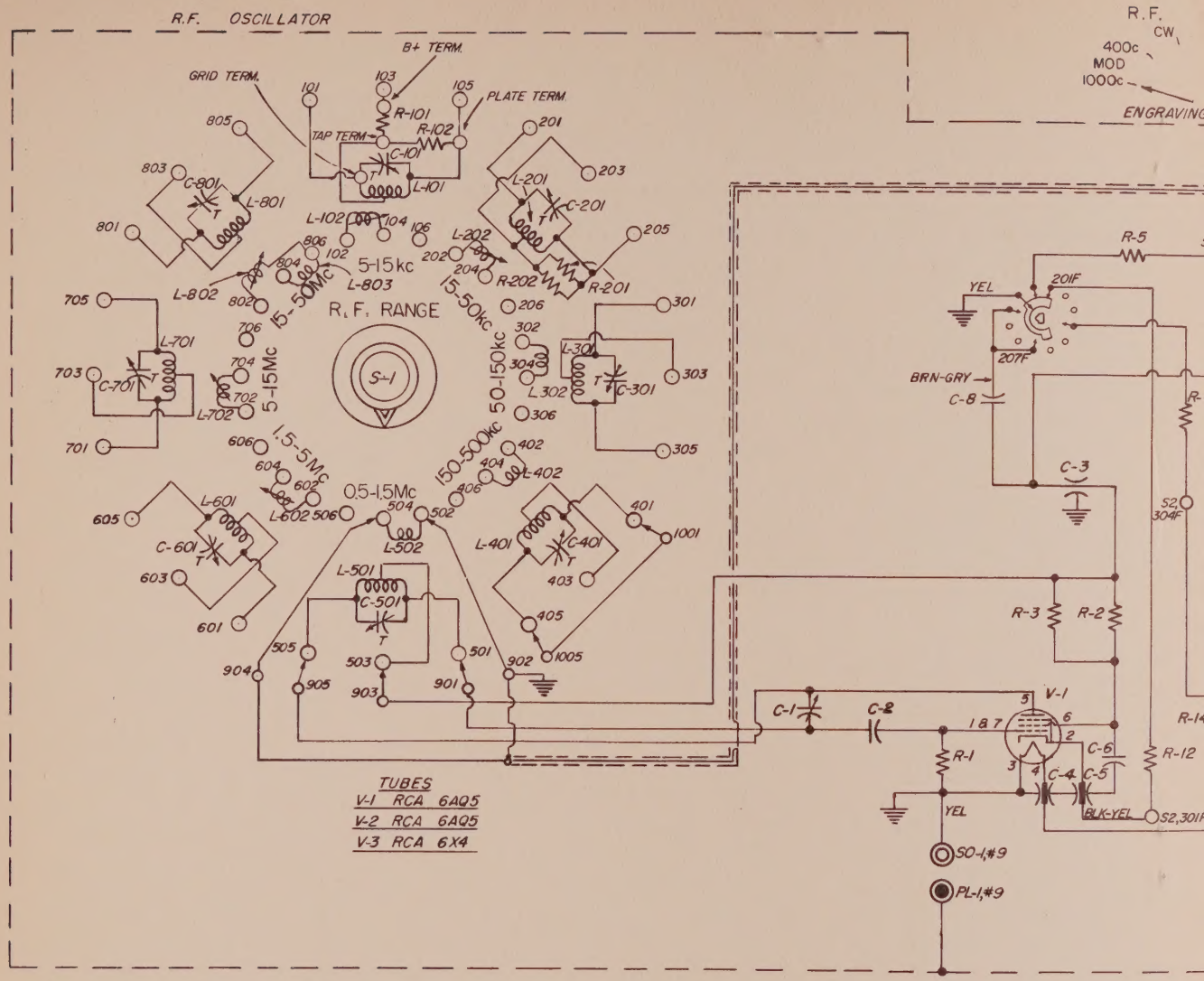
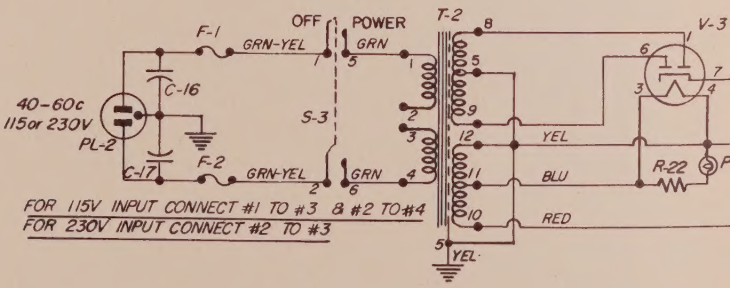
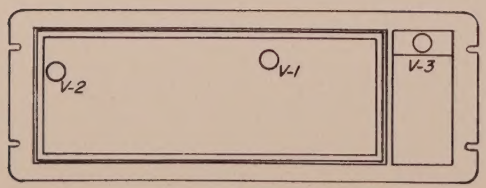
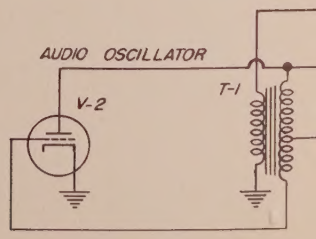


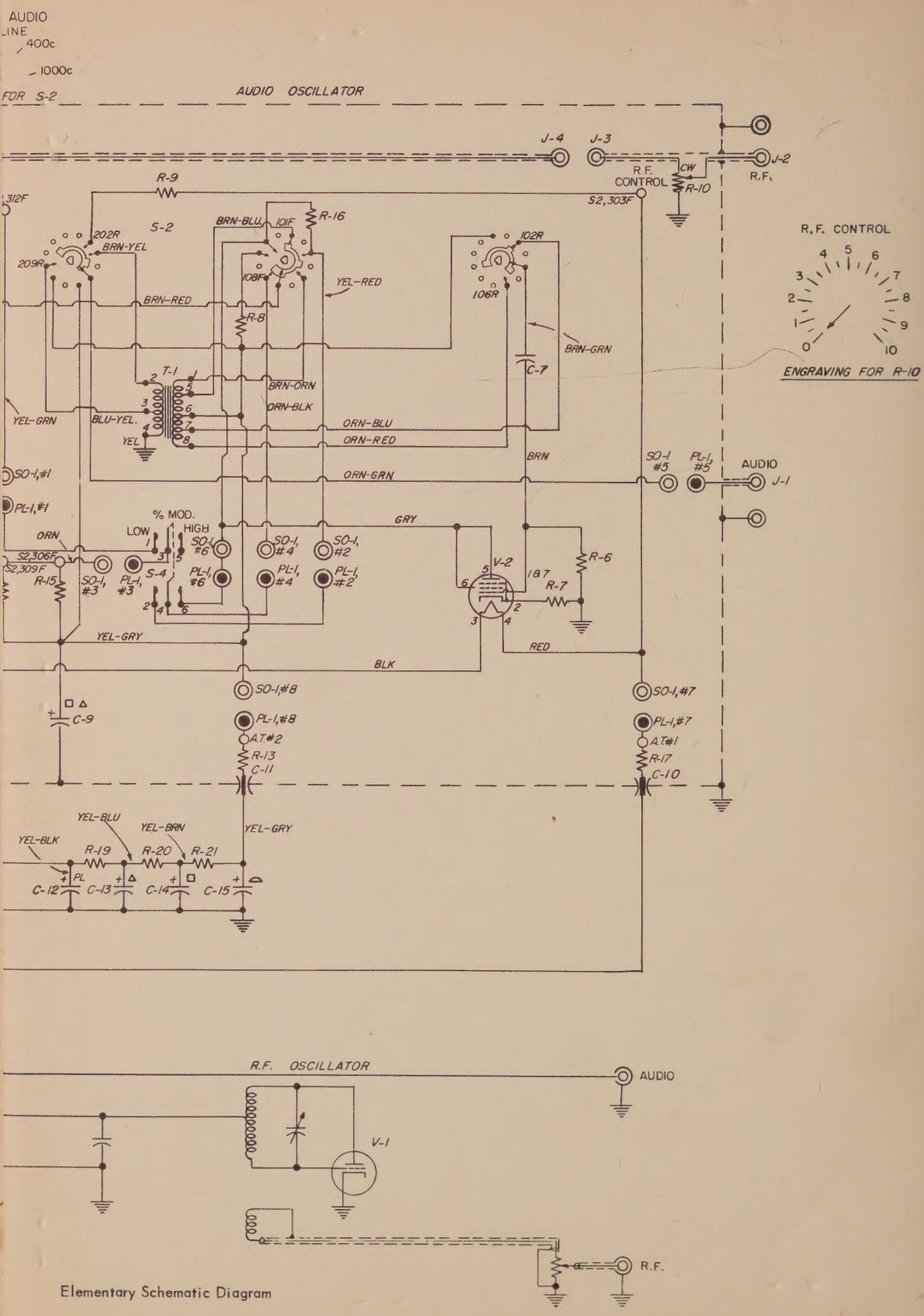
Figure 4. Schematic Diagram.





Tube Layout-Rear View





Elementary Schematic Diagram

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